

drawn around the cylinder at the following distances from the base:—13, 35, 67, 95, 148.5, 176.5, 208.5, 230.5 millimetres. The height of the cylinder was determined from the ascertained mean distance of the corresponding 37 points of intersection of the lines on the upper and lower surfaces, including the centres. The diameter of the cylinder was determined from the ascertained mean length of the 48 diameters, included between the corresponding points of intersection on its cylindrical portion.

The measurement was effected by means of an apparatus specially constructed for the purpose by Fortin, and it indicated minute differences of length of $\frac{1}{1000}$ line, or $\frac{1}{1700}$ mm.. The standard measures used for determining the absolute length measured were 16 brass measures specially constructed for the purpose, each very nearly equivalent to the height of the cylinder, and 16 other measures, each nearly equivalent to its diameter. The length of each of these two series of measures in relation to each other was ascertained by numerous observations with the new apparatus; and the total length of each set of 16 measures in relation to the new standard unit was obtained by comparing the sum of their length with Borda's *regle* of 2 toises, No. 1, to which they very nearly corresponded in length, by means of the *comparateur* used for the comparison of these large measuring rules.

The final result of the measuring operations was that the mean height of the cylinder was determined to be 2.437672 decimetres, and its mean diameter 2.428368 decimeters, at the temperature of 17° 6 C. According to Borda's determination of the coefficient of the linear expansion of brass, the volume of the cylinder was determined by computation to be nearly 11.28 cubic decimetres, when at the temperature of melting ice.

For ascertaining the weight of water displaced by this cylinder, a series of brass weights was specially constructed, consisting of a unit or provisional kilogram, made as nearly as possible of the estimated weight of a cubic decimetre of water, together with 11 exact copies and smaller weights in decimal subdivision down to the millionth part, all carefully verified and deemed to be accurate within less than half of one-millionth part.

The mean weight of the cylinder in ordinary air was taken, no reduction to a vacuum being deemed requisite, as the weights used were of similar metal to the cylinder, the interior of which communicated with the external air. For this purpose a metallic tube, 1.285 mm. in diameter, was screwed to the top of the cylinder, its end being out of the water when the cylinder was immersed. The top of the cylinder was 43 mm. from the surface of the water during the weighings, and the volume of the tube immersed was therefore 55.77 cubic mm. Taking the volume of the cylinder to be 11.28 cubic decimetres, the volume of the metallic part of the cylinder was computed to be 1.506 cub. decim., and of the hollow part filled with air 9.774 cub. decim. During the weighings the cylinder was surrounded with ice, but the temperature of the water was never below 0° 2 C. and the mean temperature was 0° 3. The final results of the weighings were declared to be as follows:—

Weight of the cylinder in air, in terms of the unit employed	Prov. kilo.
Its mean weight in distilled water, after deducting the weight of air in the cylinder, and of the air displaced by the weights used	
Hence weight of the volume of distilled water equal to the volume of the cylinder =	

H. W. CHISHOLM

(To be continued.)

NOTES

It is announced that the Transatlantic Balloon will leave New York to-day. It will carry four passengers—Prof. Wise and Mr. Donaldson, the aeronauts; an officer of the United States Signal Service, and an agent of the *Daily Graphic*. They hope to reach some point on the English or Continental coast in about sixty hours from their departure from New York. They have with them six very powerful and experienced carrier-pigeons, purchased in Belgium, which, if liberated from the balloon within "pigeon flight" of the coast, are expected to fly directly to their old homes. Each of these has painted on his breast, in indelible ink, the outline of a balloon, and on his wings the words, "Send news attached to the nearest newspaper." Despatches received by these pigeons should be sent to the nearest newspaper for publication. We wish these daring men a safe landing; but while we do this we regard the enterprise as one needlessly hazardous, so far as the settlement of the scientific problem is concerned.

MR. CAMPELL, the Chief Secretary of the Inspector-General of Customs in China, is now in Europe with a view of obtaining instruments for a complete chain of meteorological stations in that country. It is also proposed to transmit weather information all along the east coast of Asia. This is great news, and we shall return to this important matter, giving full details of the proposals.

MISS ELIZABETH THOMPSON, of New York, has made a donation to the American Association for the Advancement of Science of 1,000 dols., for the purpose of advancing scientific original research; and she intends repeating the donation annually during her life.

M. STEPHAN has succeeded in finding Faye's Comet. The correction of the *Jahrbuch Ephemeris* is almost *nil*.

MR. FROUDE, who is now with the *Devastation*, informs us that it is Mr. W. Barlow, not himself, who is president of Section G at the ensuing meeting of the British Association. Mr. Froude will, indeed, probably not even be able to attend the Bradford meeting at all.

WE learn from the *Monthly Microscopical Journal* that Prof. Gegenbauer, of Jena, the well-known comparative anatomist, has been nominated Professor of Anatomy and Director of the Anatomical Institute in the University of Heidelberg.

THE arrangement made by Prof. Henry, of the Smithsonian Institution, a few months ago, for the interchange between America and Europe, by Atlantic cable, of important astronomical discoveries and announcements, appears to have borne excellent fruit. One great object of this movement was to enable astronomers in all parts of the world to concentrate attention upon any celestial phenomenon before too great a change of place had occurred, or before the intervention of a long period of moonlight after the first discovery. On the 26th of May last Prof. Henry announced a new planet, discovered by Prof. Peters, to the Observatory of Paris, among other institutions, and on the following night it was looked for by the director of the Observatory of Marseilles, who at once detected it, and subjected it to a careful criticism. The announcement of three planets has thus far been made from the Smithsonian Institution to Europe; the only return communication being that of a telescopic comet, discovered at Vienna on July 5. On being notified of the fact, Prof. Hough, of the Dudley Observatory at Albany, made search for it, and succeeded in finding the object without any difficulty.

BIOLOGY is flourishing at the Antipodes. The last mail has brought us "Australian Vertebrata, fossil and recent," by G. Krefft, curator and secretary of the Australian Museum, Sydney; a list of Australian Longicorns, chiefly described and arranged by Francis P. Pascoe, with additional remarks by George Masters, assistant curator of the Australian Museum; Guide to the

Australian Fossil Remains exhibited by the trustees of the Australian Museum, by G. Krefft, curator and secretary; a Catalogue of the Marine Mollusca of New Zealand, by Capt. F. W. Hutton, assistant geologist; and a paper on the Geographical Relations of the New Zealand Fauna, by the same.

WE have received from the Science and Art Department the following list of Queen's Medallists in the Science Examination, May 1873; we regret that want of space compels us to give only the gold and silver medallists.—Practical Plane and Solid Geometry: Atkinson, Roger, Crewe Mech. Inst., gold; Millington, F. H., Patricoft Mech. In., silver.—Machine Construction and Drawing: Daltry, Thomas L., Newcastle, Elswick Mech. In., gold; Atkinson, Roger, Crewe Mech. In., silver.—Mathematics: McAlister, Donald, Liverpool In., gold; Edwards, Harry H., Liverpool In., silver.—Theoretical Mechanics: McAlister, Donald, Liverpool In., gold; Sisson, William, Newcastle Mech. In., silver.—Applied Mechanics: Millington, Fred. H., Patricoft Mech. In., gold (obtained gold medal in 1872); Dixon, Samuel, Manchester Mech. In., gold; Daltry, Thomas L., Newcastle, Elswick Mech. In., silver.—Acoustics, Light, and Heat: Martin, T. W., Newton Abbott, gold; McAlister, D., Liverpool Inst., silver.—Magnetism and Electricity: McAlister, Donald, Liverpool Inst., gold; Louis, Henry, Islington Sci. and Art Sch., silver.—Organic Chemistry: Whiteley, John, Halifax W. M. Coll., gold; Taylor, William D., Belfast, W. M. Inst., silver.—Geology: Dowlen, Ethelbert, Woking, St. John's, gold; Southeran, Arthur, Marske Inst., silver.—Vegetable Anatomy and Physiology: Dowlen, E., Guildford Science, silver.—Navigation: Windass, John T., Hull Nav. Sch., gold; Daws, Thomas, Plymouth, Courtenay Street Sch., silver.—Nautical Astronomy: Lawson, Henry, Hull Nav. Sch., silver (obtained silver medal in 1872); Ashford, Joseph, Hull Nav. Sch., silver.—Steam: Fairweather, James, Glasgow, Anderson Univ., gold; Daltry, Thomas L., Newcastle, Elswick Mech. Inst., silver.—Physical Geography: Forbes, James L., Torphins Sci. Sch., gold; Armstrong, J. W., Blackburn School of Science and Art, silver.

MR. J. WOOD-MASON, of Queen's College, Oxford, is to officiate as Professor of Comparative Anatomy and Curator of the Comparative Anatomy Section of the Medical College Museum, Calcutta, during the absence, on furlough, of Dr. J. Anderson.

MESSRS. LONGMANS announce the following among their forthcoming scientific publications:—A new volume of Transatlantic Travel, entitled "The Atlantic to the Pacific; What to See, and How to See it," by John Erastus Lester, M.A., author of "The Yo-Semite, its History, Scenery, and Development." A study of Asiatic savage life, entitled "A Phrenologist amongst the Todas, or the Study of a Primitive Tribe in South India—History, Character, Customs, Religion, Infanticide, Polyandry, Language," by William E. Marshall, Lieut.-Col. of H.M. Bengal Staff Corps. A second Supplement to Watts's "Dictionary of Chemistry." The first Supplement, bringing the record of chemical discovery down to the end of the year 1869, was published in 1871. The second Supplement, now in course of preparation, is intended to bring the record of discovery down to the end of 1872, including also the more important additions to the science published in the early part of 1873. This Supplement will form a volume of about 800 pages, and is expected to be ready in the year 1874. The author has been fortunate in securing the co-operation of several of his former contributors. A new work on "Sideral Astronomy," by R. A. Proctor. "Introduction to Experimental Physics, Theoretical and Practical, including Directions for Constructing Physical Apparatus and for Making Experiments," by Adolf F. Weinhold, Professor in the Royal Technical School at Chemnitz, translated and edited (with the author's sanction) by Benjamin Loëwy, F.R.A.S., with a Preface by G. C. Foster, F.R.S., Professor

of Physics in University College, London. "A Treatise on Practical, Solid, or Descriptive Geometry, embracing Orthographic Projection and Perspective or Radial Projection," by W. T. Pierce, Architect, late Lecturer on Geometrical Drawing at King's College, London, and at Harrow School. "On the Sensations of [Tone, as a Physiological Basis for the Theory of Music," by H. Helmholtz, Professor of Physiology, formerly in the University of Heidelberg, and now in the University of Berlin, translated from the third German Edition by Alexander J. Ellis, F.R.S., formerly Scholar of Trinity College, Cambridge. "Organic Chemistry," by H. E. Armstrong, Ph.D., Professor of Chemistry in the London Institution; "A Manual of Qualitative Analysis and Laboratory Practice," by T. E. Thorpe, F.R.S.E., Professor of Chemistry in the Andersonian University, Glasgow, and M. M. Pattison Muir; "Telegraphy," by W. H. Preece, C.E., Divisional Engineer Post Office Telegraphs, and J. Sivewright, M.A., Superintendent (Engineering Department) Post Office Telegraphs; "Elements of Machine Design, with Rules and Tables for designing and drawing the Details of Machinery," adapted to the use of Mechanical Draughtsmen and Teachers of Machine Drawing, by W. Cawthorne Unwin, B.Sc. Assoc. Inst., C.E., Professor of Hydraulic and Mechanical Engineering at Cooper's Hill College; "Principles of Mechanics," by T. M. Goodeve, M.A., Lecturer on Applied Mechanics at the Royal School of Mines, and formerly Professor of Natural Philosophy in King's College, London. These five works form part of the series of text-books now being published by the Messrs. Longmans.

AMONG Messrs. Macmillan's announcements of forthcoming works are—"On the Theory of Sound," by Lord Rayleigh, F.R.S.; "Contributions to Solar Physics," by J. Norman Lockyer, F.R.S., with numerous illustrations; "Cave Hunting," by W. Boyd Dawkins, F.R.S., being researches on the evidence of caves respecting the early inhabitants of Europe; "The Origin and Metamorphoses of Insects," by Sir John Lubbock, F.R.S. (vol. ii. NATURE Series); and a new edition of Canon Kingsley's "Glaucus."

DURING the ensuing season Messrs. H. S. King and Co. will publish the following new volumes of their "International Scientific Series":—"Mind and Body," by Alex. Bain, LL.D.; "Animal Mechanics," by J. Bell Pettigrew, M.D., F.R.S.; "Principles of Mental Physiology," by W. B. Carpenter, LL.D., F.R.S.; "On the Conservation of Energy," by Prof. Balfour Stewart; "The Animal Machine, or, Aërial and Terrestrial Locomotion," by Prof. C. J. Marey; "The Study of Sociology," by Herbert Spencer. With the exception of the last-named work, the whole of the above will be illustrated.—Messrs. H. S. King and Co. also announce the following books of interest to scientific men:—"Studies of Blast-furnace Phenomena," by M. L. Gruner, translated by L. D. B. Gordon; "The Norman People and their Existing Descendants in the British Dominions and the United States of America," and "The History of the Natural Creation," a series of popular Scientific Lectures on the Theories of Progression of Species, by Prof. Ernst Hæckel.

MR. VAN VOORST has recently published new editions of "Blackwall's Researches in Zoology, illustrative of the Structure, Habits, and Economy of Animals," and Salvin and Brodrick's "Falconry in the British Isles."

PROF. E. D. COPE has been bold enough, in the August number of the *Penn Monthly* (Philadelphia), to portray his conception of the general external appearance of the new gigantic mammal from Wyoming, named *Tinoceras anceps* by Marsh, and *Loxotophodon cornutus* by himself. The result is an elephantine form, with elephantine knees, feet, ears, and tail; bovine preputial sheath; and a head with two pairs of somewhat cervine horns, and an anterior pair of simple but diverging processes. A proboscis about half as long as the head is made to project for-

wards in a Tapir-like manner, below the base of which the upper canines descend in a way which shows that it would be impossible to use them for defence or obtaining food, without doing great injury to the sensitive trunk which overshadows them. Nothing seems more illogical than the assumption, that because an animal has elephantine proportions and feet, it should possess a proboscis, especially when all arguments from the skull tend in a different direction.

THE Quarterly Weather Report, from July to September, contains, in addition to the usual tabular results, a discussion of four years anemometrical results for Bermuda.

WE have received the Report on the Freshwater Fish and Fisheries of India and Burmah, by Surgeon-Major Francis Day, Inspector-General of Fisheries in India.

WE have received from Prof. Edward Morse an excellent paper, read by him before the Boston Society of Natural History, on the Systematic Position of the Brachiopoda, in which, from a careful study of the anatomy and development of those animals, he has been led to endorse and substantiate Steenstrup's opinion as to their affinities being with the Annelids instead of with the Mollusca, as generally believed. The following is his concise summary:—"Ancient Chaetopod worms culminated in two parallel lines—on the one hand in the Brachiopoda, and on the other in the fixed and highly cephalized Chaetopods. The divergence of the Brachiopoda, having been attained in more ancient times, a few degraded features are yet retained, whose relationships we find in the lower Vermes; while from their later divergence the fixed and cephalized Annelids are more closely allied to present free Chaetopods." The author lays stress on the certainly soft and uncalcified condition of the earliest forms of life causing great imperfection in the earliest geological record.

IN the death of Mr. William S. Sullivant, which is recorded in the scientific columns of *Harper's Weekly*, and which took place at Columbus, Ohio, on April 30 last, the United States has lost one of its most accomplished botanists, especially in the department of the mosses, in which he was the recognised head for many years. From a biographical notice published by Professor Gray in the *American Journal of Science*, we learn that Mr. Sullivant was born in 1803, near Columbus, in the vicinity of which place he resided the greater part of his life. His first publication appeared under the title of *Musci Alleghanienses*, a work on the mosses and liverworts of the Alleghany Mountains, illustrated by prepared specimens of the plants themselves. This was shortly after 1843, and a few years later a work on the same subject was published in successive numbers as a memoir of the American Academy. The section of Mosses and Hepaticæ in Prof. Gray's *Botany of the Northern United States* was prepared by Mr. Sullivant, and credited to his pen. A separate edition was subsequently published by the author. A work on the mosses of Cuba was prepared by him, illustrated by specimens collected by Mr. Charles Wright. He also published, in 1859, the account of the mosses collected by the Wilkes expedition. The most important of Mr. Sullivant's publications, however, consists of his *Icones Muscorum*, being "figures and descriptions of most of those mosses peculiar to Eastern North America which have not been heretofore figured"—this forming an imperial octavo volume with 129 copper-plates. It is stated by Prof. Gray that a second or supplementary volume of *Icones* was in preparation by Mr. Sullivant, and nearly completed at the time of his death.

THE additions to the Zoological Society's Gardens during the past week include two Mouflons (*Ovis musimon*) from Sardinia, presented by Mr. H. E. Holloway; two Barbel (*Barbus vulgatus*) and a Bream (*Abramis brama*) from British seas, pre-

sented by Mr. E. S. Wilson; two Sacred Ibises (*Geronticus athiopius*) from Gough's Island; a Black-handed Spider Monkey (*Atles melanochir*) from Central America, purchased; five Horned Lizards (*Phrynosoma cornutum*) from California, deposited.

SPÖRER'S OBSERVATIONS ON THE SUN*

THE author gives chiefly the results of his spectrum observations, and simultaneous spot observations, recorded in the Transactions of the Berlin Academy of Sciences for November 1871, and May 1872. To the two earlier instances of striking changes observed in the protuberances, there is added an interesting observation of August 8, 1872. It was estimated that the prolongation of the upper part of the protuberance had a velocity of forty-two kilometres per second, parallel to the sun's surface. In the case of many protuberances, it will be readily allowed that they are not only subject to cyclones, but also owe their origin to them. Protuberances of similar form, observed on several successive days, in the same heliographic latitude, Spörer has accounted for, by the supposition of volcanic eruptions, owing to the smaller rate of linear rotation of the deeper strata; if, however, we regard these protuberances as the results of cyclones, the explanation of the changes of position would rest upon the impelling power of the storms, and their tendency to create new forms; and the velocity of the advancing cyclone would, in several instances, average 1·4 kilometre.

Spörer, in this work, adheres to his division of protuberances into two classes. Secchi, in his work on the Sun, has distinguished four classes of protuberances, but afterwards accepted Spörer's twofold division. Both observers are at one in this, that the protuberances, which Spörer has named "flame" and Secchi "ray" protuberances, give different spectral lines, and stand in intimate connection with the spots. But with regard to the proper hydrogen protuberances, Secchi says they are not in the condition to give rise to a spot, against which Spörer adduces examples of their influence in neighbouring spot formation, especially prominent in the intervals between considerable protuberances of hydrogen.

The observation of the protuberance, which Secchi also noticed, on July 7, 1872, and which gave a well-marked image with the line 6543, is particularly described, and drawings are appended.

With regard to observations of spots, interesting comparisons are given, showing the difference between the two hemispheres in respect to the frequency of spots, and the mean heliographic latitudes. In this connection, Carrington's observations, from November 1853 to the beginning of 1861, are gone into, so that the comparisons embrace a period extending from November 1853 to the end of 1871. With regard to frequency of spots, it appears that the southern hemisphere exceeds the northern both in maximum and minimum. The curves also show distinctly the rapid passage from minimum to maximum, and the slow decrease after the maximum.

The mean heliographic latitudes are obtained through assigning to each group of spots, a factor of value (*Werthfactor*). The union of five-rotation periods gave a point of the curve for the northern as well as for the southern hemispheres. Carrington had obtained from his observations the striking result, that the spots at the time of the minimum approach the equator, thereafter veered off to higher latitudes, and that then the more numerous spotted zones gradually approached the equator. Spörer, by his observations since 1861, has confirmed this result.

* Translated from a review in *Der Naturforscher*, No. 29, of Beobachtungen der Sonne, von Prof. Dr. Spörer, Abhandlung zum Programm des Gymnasiums. Separat-Abdruck. Anklam. Verlag und Druck von Richard Poettcke: 1873.